Claims

1. A heat exchanger or fluid mixing means comprising a bonded stack of plates, the stack comprising at least one group of plates, comprising one or more perforated plates (50) sandwiched between a pair of primary separator plates, each perforated plate has a plurality of perforations arranged in rows across the plate in a first direction, with a land between each adjacent pair of perforations in a row and with ribs (54) between adjacent rows, the lands forming barriers to flow in the first direction across the plate and the ribs forming barriers to flow in a second direction across the plate, the second direction being normal to the first direction, the ribs (54) having vents (56) through a portion of their thickness, the vents extending from one side of a rib to the other side in the second direction, whereby flow channels are provided through the vents and the flow channels defined by the perforations lying between each adjacent pair of lands provide a flow passage to cross the plates in the second direction, wherein a deposit of catalytic material is retained within the passageways of the said at least one group of plates.

2. A heat exchanger or fluid mixing means comprising a bonded stack of plates, the stack comprising at least one group of plates, comprising one or more perforated plates (50) sandwiched between a pair of primary separator plates, each perforated plate has a plurality of perforations arranged in rows across the plate in a first direction, with a land between each adjacent pair of perforations in a row and with ribs (54) between adjacent rows, the lands forming barriers to flow in the first direction across the plate and the ribs forming barriers to flow in a second direction across the plate, the second direction being normal to the first direction, the ribs (54) having vents (56) through a portion of their thickness, the vents (56) extending from one side of a rib (54) to the other side in the second direction, whereby flow channels are provided through the vents (56) and the flow channels defined by the perforations lying between each adjacent pair of lands provide a flow passage to cross the plates in the second direction, wherein the deposit of catalytic material is formed in the perforations of the perforated plate(s).

3. A heat exchanger or fluid mixing means according to claim 2, wherein the perforations of the perforated plates are elongate slots (52).

4. A heat exchanger or fluid mixing means according to claim 3, wherein the vent has a base surface and the deposit is formed in the slots (52) to a level with said base surface.

5. A heat exchanger or fluid mixing means according to claim 2, characterised in that the vents (56) are formed on one surface of their rib (54) to extend partially into the thickness of the rib (54).

6. A heat exchanger or fluid mixing means according to claim 5, wherein the vents (56) in adjacent pairs of ribs (54) are offset from each other.

7. A heat exchanger or fluid mixing means according to claim 6, characterised in that the vents (56) are formed normal to the direction of the rib (54).

8. A fluid mixing means comprising a bonded stack of plates, the stack comprising in series a plurality of passageways for a first coolant or heating fluid stream, one or more first perforated plates (170) for providing a plurality of passageways to receive a reactant fluid, one or more second perforated plates (120) for providing a plurality of passageways (105, 124) in which catalytic material is packed to receive a process fluid and a plurality of passageways for a second coolant or heating fluid whereby the reactant fluid passageways and process fluid passageways are connected thereby to mix the reactant fluid and process fluid in the presence of a catalyst and in temperature controlled conditions.

9. A fluid mixing means according to claim 11, wherein the passageways (105, 124) formed by the second perforated plate run through the fluid mixing means and are accessible to enable the catalyst to be packed in the passageways and removed when required.

10. A fluid mixing means according to claim 9, wherein the perforations of the second perforated plates (12) are elongate slots and the catalytic material are packed in the slots.

11. A fluid mixing means according to claim 9, characterised in that the passageways (105,124) to contain catalytic material are defined in one or more plates (120) and lie between parallel ribs (123) running the length of those plates (120).

12. A fluid mixing means according to claim 8, characterised in that vents are formed partway through the thickness of the parallel ribs to provide pressure equalising means between the passageways (105, 124) to contain catalytic material.

13. A fluid mixing means according to claim 8, wherein the passageways for first and second coolant or heating fluid streams are provided by one or more third perforated plates (170) comprising a border region for bonding adjacent plates and a central region having a plurality of vented ribs defining passageways for coolant fluid or heating streams.

14. A fluid mixing means according to claim 13, wherein the third perforated plates (170) are provided with a central pin-fin region.

15. A fluid mixing means as claimed in claim 13, wherein the first and second perforated plates (170, 120) are separated by an injection plate (I) having a series of injection holes 190, whereby the reactant fluid is caused to be injected into the process fluid to cause the desired chemical reaction.

16. A fluid mixing means according to claim 15, wherein the second and third perforated plates and the injector plate (I) are provided at their edges with extensions (173, 183, 193) which fit together in the stack to provide one or more tanks on the side faces of the stack.

17. A fluid mixing means according to claim 8, wherein the first perforated plates (170) are provided with a central pin-fin region.

18. A fluid mixing means comprising a bonded group of plates which group of plates comprise in series, a first separator plate (S), a stack (A) of first perforated plates for providing a plurality of passages for a coolant or heating fluid stream, a second separator plate (S), a stack of second perforated plates for providing a plurality of passages to receive a reactant fluid, an injection plate (I), and a stack (C) of third perforated plates for providing a plurality of passageways for a process fluid, and a third separator plates, whereby the reactant fluid is caused to be injected into the process fluid to be mixed in the presence of a catalyst contained in the stack (C) of the third perforated plates.